Abstract Submitted
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Low Aspect Ratio Fusion Nuclear Science Facility Mission and Parameter Space[1] Y.-K.M. PENG, A. SONTAG, S. DIEM, J. CANIK, M. COLE, ORNL, P.J. FOGARTY, DevTech, M. KOTSCHENREUTHER, P. VALANJU, UT-Austin — A Fusion Nuclear Science Facility (FNSF) is needed to bridge critical knowledge gaps between ITER and current R&D toward a fusion DEMO. The FNSF aims to subject, *for the first time*, components that tame the plasma-material interface and harness fusion power to the rigors of a full fusion nuclear environment, continuously for up to 10^6 s. This would test and reveal new physical properties and issues of interest, encourage R&D to innovate and improve, and iterate to arrive at the component design knowledge needed to begin power engineering and technology testing. Physical properties include, for example, tritium permeation through material layers of plasma facing components; tritium extraction from solid breeders; thresholds of measurement of tritium concentration in fusion chamber. These encompass wide ranges of time constants (10^3 – 10^6 s) and fusion neutron fluxes (0.01 – 1 MW/m^2). A set of aspect-ratio-dependent plasma physics and engineering assumptions are used to estimate the parameter space of the FNSF, covering the entire range of neutron flux. It is found that for plasmas with R = 1.2 m, B = 2.2 T, A = 1.5, and kappa = 3, the required plasma current ranges from 3.5 MA to 8.5 MA, q_{cyl} = 8.5 to 3.5, and Q = 0.05 to 2.5. The relationship with design parameters of higher aspect ratios will also be discussed.

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Y.-K. M. Peng
ORNL

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